AMENDMENTS

In the Specification:

Page 4, lines 17-26, amend paragraph as follows:

The main housing of the tool defines a chamber 110 for the brush bar 112, a chamber 115 for the turbine 240 and flow ducts between these parts. The forward, generally hood-shaped, part [[110]] of the housing and a lower plate together define a chamber for housing the brush bar. The brush bar comprises two brush bars 112 of equal size which are supported, cantilever fashion, from a part of the driving mechanism positioned in the centre of the chamber 110. The lower plate has a large aperture 111 through which the bristles of the brush bars 112 can protrude to agitate the floor surface. The lower plate is fixed to the remainder of the housing by quick release (e.g. quarter turn) fasteners so that the plate can be removed to gain access to the brush bars 112.

Page 6, lines 1-6, amend the paragraph as follows:

The turbine and the control mechanism for the turbine will now be described in detail with reference to Figure 3. The impeller [[240]] of the turbine <u>240</u> is mounted about a drive shaft 245 within chamber 115. A set of bearings 246, 247 rotatably supports the drive shaft 245 at each of its ends. An air inlet 120 to the turbine is positioned at <u>one</u> end [[200]] of the housing and an air outlet of the turbine is mounted at end 280. Airflow through the turbine is in a generally axial direction from left to right in Figure 3.

Page 6, line 26, to page 9, line 4, amend the paragraphs as follows:

The outermost surface of the button 200, between the inner 201 and outer 202 annular hubs, comprises a plurality of radial ribs 206, with the spaces between adjacent ribs defining air inlet apertures 205. The inlet apertures 205 are shielded by a finely graded mesh which serves to prevent dust from being carried into the turbine and fouling the mechanism. The passage between the outer annular hub 202 and diaphragm seal 210, and the inner annular hub 201, defines an airway 120 for the incoming airflow which drives the ~~impeller~~ <u>turbine</u> 240. The

circumference of the guide vane plate 230 supports a set of angled vanes 232. The angle of the vanes 232 serves to initiate a swirling flow of air around the housing which is matched to the angle of the blades on the ~~impeller~~ turbine 240. The main airflow path through the turbine is shown by the arrows adjacent secondary impeller 244 as described below. The ~~impeller~~ turbine 240 shown here is an inward radial flow (IFR) turbine, which has been found to be well-suited to the pressure and flow rates in this application. However, it will be apparent that other types of turbine could be used, such as a Pelton Wheel.

There is also a secondary flow of air which plays an important part in operating the button 200 during an overspeed condition. The generally flat side of the ~~impeller~~ turbine 240 (the left hand side of the impeller 240 in Figure 3) has a plurality of depressions 242 defined in it, separated by ribs 243. In use, these depressions 242 and ribs 243 act as a miniature impeller, which will hereafter be called a secondary impeller 244. Obviously, since the secondary impeller 244 is the rear face of the ~~impeller~~ turbine 240, the two rotate at the same speed. The pumping effect of the secondary impeller 244 is proportional to the rotational speed of the ~~impeller~~ turbine 240. This causes a region of low pressure between the guide vane plate 230 and ~~impeller~~ turbine 244. A plurality of axially directed apertures 234 in the supporting plate 230 join the region directly behind the ~~impeller~~ turbine 244 with the region inside the button 200. The region inside the button is effectively a chamber which is separated from the main airflow path, except for the restricted path through the apertures 234. The only other flow into region 216 is a small, inevitable, leakage between the inner annular hub 201 of button 200 and the part of the inlet cap 220 against which the button 200 slides. The size of the apertures 234 is a trade off between being sufficiently large so as to effectively communicate the pressure behind the secondary impeller 244 to the region 216 inside the button 200, and sufficiently small so that a large enough pressure difference is present in button 200 to enable a pumping effect to work. In use, the pumping action of the secondary impeller 244 reduces the pressure in region 216. The forces at work are shown in Figure 3. The spring 215 inside the button applies

a force, labelled F_S, in an axially outward direction. There is also an axially directed force F_{PD} on the button 200 which results from the pressure difference between ambient pressure on the outside of button 200 (shown as the large inwardly directed arrow) and the pressure in region 216 inside the button 216. When the vacuum cleaner is switched off, the air in region 216 is also at ambient pressure and thus the only net force acting on the button is that due to the spring 215. However, when the vacuum cleaner is operating, the pressure in region 216 is less than ambient due to the partial evacuation of air from region 216 by the secondary impeller 244. This pressure difference causes an axially inwardly directed force acting on the button. When the impeller is rotating at normal speeds, i.e. around 25-30Krpm, the inwardly directed force F_{PD}, which is related to the pressure difference between ambient and the region inside the button 200, is insufficient to overcome the axially outwardly-directed biasing force of the spring F_S. Thus, the button 200 remains in the open position and air continues to flow to the ~~impeller~~ <u>turbine</u> 240 to operate the brush bar.

When the airflow path through the main inlet becomes blocked in some way, such as by an object becoming trapped in the ducting or by the suction inlet becoming sealed against a surface, an increased amount of air will flow through the air inlet 120 to the turbine <u>240</u>. This increase in airflow will increase the speed of rotation of the ~~impeller~~ <u>turbine</u> 240 and secondary impeller 244. Other faults, such as a breakage of the drive belt 260, can also cause an increase in the rotational speed of the ~~impeller~~ <u>turbine</u> 240. When the speed of rotation increases to a predetermined level, the pumping action of the secondary impeller 244 causes a sufficient pressure difference between ambient and the region 216 inside the button 200, that the axially inwardly directed force on the button F_{PD} can overcome the outwardly directed biasing force of the spring, F_S. Thus, the button 200 moves into the closed position, as shown in Figure 4, and the diaphragm seal 210 presses against the inlet cap 220 to seal the inlet in an airtight manner. This prevents any air from reaching the ~~impeller~~ <u>turbine</u> 240. As a result, the ~~impeller~~ <u>turbine</u> 240 and the brush bar come to rest. Since the outlet side 280 of the turbine chamber continues

to be in communication with the suction duct between the main suction inlet 111 on the tool and the main body 70 of the vacuum cleaner, which continues to be at low pressure, region 216 remains sufficiently evacuated to maintain the button 200 in the closed position. The speed of rotation which causes the button to move into the closed position is determined by factors which include the strength of the spring 215. We have found a maximum of speed of 45-50Krpm is an ideal limit, but this can, of course, be varied.

Page 10, lines 10-19, amend the paragraph as follows:

Figure 7 shows a scheme where a manually operable valve is mounted downstream of the turbine 240, as part of the tool 100. A button 320 is ordinarily biased into a closed position, as shown, by spring 330. The spring 330 acts between a step on the axially innermost end <u>321</u> of button 320 and surface 322 of the chamber in which the button lies. In use, a user can displace the button 320 to admit air through inlet 340 into the region 280 downstream of the turbine. The region inside button 200' is in communication <u>through opening 323</u> with the region 280 into which the air is bled by button 320. Thus, the force F_{PD} due to evacuation of the button 200' will be reduced. When the value of F_{PD} is reduced sufficiently, the spring force F_S will overcome the inwardly directed force F_{PD} and the button 200' will move to its open position, as shown in Figure 3.

Page 11, line 30, to page 12, line 27, amend the paragraphs as follows:

Referring to Figures 8 – 11, a restricting device 800 is positioned in the outlet duct <u>891</u> from the brush bar housing 110. The restricting device serves to restrict the flow of air from the brush bar housing. The restricting device is designed to distribute incoming air between the main and turbine inlets in a satisfactory ratio. We have found that allowing a ratio of between one quarter airflow through the turbine to three quarters airflow through the main inlet and one third airflow through the turbine to two thirds airflow through the main inlet provides good results.

In the embodiment shown in Figures 8 - 11 the restricting device 800 has a base 815 with fixings 816, 817 which push fit into the wall 892 of the discharge outlet <u>891</u> so as to secure the restricting device 800 in place. A loop 805, 810 of material is secured to the base 815. The loop has a first part 805, which will be called a guide vane, which is inclined with respect to the base 815. A generally semi-circularly shaped element 810 joins the guide vane 805 with the base 815. The guide vane 805 and semi-circular element 810 can be molded integrally with one another, and with the base 815, from a material which is resiliently flexible. A rubber compound such as EPDM is suitable. In use, the guide vane 805 remains in an inclined position to the base 815, and hence the walls 892, 893 of the discharge outlet <u>891</u>, and serves to restrict the cross-section of the outlet, as can be seen in Figure 11. Reference numeral 896 represents the part of the outlet aperture through which air can flow. The angle of inclination of guide vane 805, in use, will usually be less than what is shown in Figure 8 due to the force caused by the flow of air through the outlet, but it will still be inclined. In the event that a large piece of debris flows along the outlet duct, the guide vane 805 rotates towards wall 892, adopting a position which is more parallel with the base member 815. Narrowed portion 806 between guide vane 805 and base 815 acts as a hinge to permit guide vane 805 to rotate. Once the debris has passed, the guide vane 805 returns to its original position, due to the resilience of element 810. Vertical walls 894 of the discharge outlet <u>891</u> lie alongside each side of the device 800 and thus the area inside the loop is not exposed to dirt-laden airflow.

Page 14, lines 11-20, amend the paragraph as follows:

The preferred way of operating the button 200 is to provide a secondary impeller <u>244</u> on the rear face of the ~~impeller~~ <u>turbine</u> 240. Depressions 242 and ribs 243 form this secondary impeller. However, the following alternative schemes are also possible, and are intended to be included in the scope of the invention. Instead of using the rear face of impeller 240, a second, dedicated, impeller could be mounted on the drive shaft 245 at a position which is axially offset from the main ~~impeller~~ <u>turbine</u> 240. Obviously, this would increase the cost and size of the

tool. As a further alternative, the rear face of the ~~impeller~~ turbine 240 could be flat, rather than having depressions 242 and ribs 243. As a still further alternative, the means for evacuating the region 216 inside the button can be a venturi in the main airflow path to or from the turbine.